Smelling Lavender and Jasmine with Advance Information about Their Psychological Effects: An Examination of the Placebo Effect

Tohoku Psychologica Folia
2002, **61**, 1－10

Smelling lavender and jasmine with advance information about their psychological effects: An examination of the placebo effect.

HIGUCHI TAKAHIRO (樋口貴広)[1], SHOJI KEN (庄司　健)[2],
(*Yokohama National University*) (*Shiseido Product Development Center*)

HATAYAMA TOSHITERU (畑山俊輝)[3]
(*Tohoku university*)

The present study tested whether or not the mood of an individual while smelling a fragrance was affected by having advance information that the fragrance possessed some mood-improvement effects. Participants were instructed to smell lavender and jasmine, which are considered to possess sedative and stimulating effects, respectively, in either of three conditions: with no information about the effects (no information), with advance information that the stimulus would make them feel relaxed (relaxing information) or with advance information that it would make them feel stimulated (stimulating information). The results showed that, while smelling lavender, participants in the relaxing information condition were significantly less stressed than those in the other conditions. When they smelled jasmine, by contrast, the participants in the no information condition were significantly more stimulated than those in the relaxing information condition. These findings suggested that the advance information can help achieve a sedative effect in the case of smelling lavender but that it negatively affected the stimulating effect of jasmine. Possible reasons for the different effects found between lavender and jasmine were discussed.

Key words: placebo effect, subjective mood states, lavender and jasmine, aromatherapy

Introduction

In practices such as aromatherapy, it is considered that lavender has a sedative effect, while jasmine has a stimulating one (e.g., Hayashi, 1998; Seller, 1992). Previous studies have proved the existence of such effects with psychophysiological measures. In studies of contingent negative variations (CNV) that reflect cognitive activities such as expectancy and attention (Walter, Cooper, Aldridge, McCallum, & Winter, 1964), lavender was found to decrease CNV activities and jasmine to increase them (Okazaki, 1992; Sugano, 1992; Torii, Fukuda, Kanemoto, Miyauchi, Hamauzu, & Kawasaki, 1988). In their electroencephalogram (EEG) studies, Yagyu

1. Correspondence concerning this article should be addressed to the first author, T. Higuchi (E-mail: higuchit@comp.metro-u.ac.jp). The first author is now postdoctoral fellow at Department of Kinesiology, Graduate School of Science, Tokyo Metropolitan University. 1-1, Minami-Ohsawa, Hachioji, Tokyo, 192-0397, Japan.
2. Shiseido Product Development Center 2-2-1, Hayabuchi, Tsuzuki, Yokohama, 224-8558, Japan
3. Department of Psychology, Graduate School of Arts and Letters, Tohoku University Kawauchi, Aoba, Sendai, 980-8576, Japan

(1994) and Sugano (1992) also showed that lavender increased alpha ingredients (7-12Hz) and that jasmine increased beta ingredients (13-30Hz). The findings in the CNV and EEG studies suggest that lavender reduces the activities of the central nervous system, whereas jasmine enhances them, resulting in the sedative effect of lavender and the stimulating effect of jasmine.

Several studies, however, have failed to find such effects of lavender and jasmine in spite of using similar measures to those in the aforementioned studies. Miyake, Nakagawa, and Asakura (1991) failed to show any changes in EEG patterns while smelling lavender. Kanamura, Kawasaki, Indo, Sukuda, and Torii (1988) indicated that not only jasmine but also lavender had stimulating effects by showing that both fragrances increased the participant's skin potential level (SPL). In studies using subjective ratings of mood states, Higuchi, Shoji, and Hatayama (2002) showed that the perceptual impression of lavender was intense and less associated with relaxation and that the perceptual impression of jasmine was intense, less clear, and not associated with stimulation but, rather, with stress. The lack of broad agreement among previous studies can result from several factors. It is sometimes caused by whether the fragrance stimulus used is a synthetic substance (called "aroma chemicals") or a natural essential oil (Steiner, 1994) and by differences in contingent properties of the fragrance stimulus, such as colors in a liquid (Zellner & Whitten, 1999). It is also possible that participants sampled in respective studies have different cultural as well as individual backgrounds with regard to the use of a particular fragrance, resulting in different emotional reactions among participants to the same fragrance stimulus (Baeyens, Wrzesniewski, Houwer, & Eelen, 1996; Kirk-Smith & Booth, 1987; Ayabe-Kawamura, Schicker, Laska, Hudson, Distel, Kobayakawa, & Saito, 1998; Schleidt, Neumann, & Morishita, 1988).

As a framework of understanding the confusing effects of fragrances, Jellinek (1994, 2002) insisted on the importance of considering the placebo effect (i.e., the effect of getting information about the effects that a fragrance possesses prior to smelling the fragrance). Jellinek suggested that the expectancy of a positive effect of a fragrance can in itself bring such effects, even though individuals are presented with "odorless" air (i.e., no smell), and that this process is independent of perceptual processes brought by a smell, of pharmacological processes brought by chemical substances of fragrances (i.e., not by a smell but by chemical properties of fragrances), and of hedonic processes brought by the emotional system. This suggestion is supported by Knasko, Gilbert, and Sabini (1990), in whose study participants were presented with odorless air together with advance explanations of the effects of "imaginary" odor. Their study showed that the participants evaluated their health states in accordance with the explanations they had been given about the effects of the odor, in spite of the fact that no odor had been presented to the participants.

The placebo effect may contribute to amplifying the psychological effects of fragrances in real-world settings. Generally speaking, for example, when consumers buy fragrance products such as essential oils, they not only test the smell but also read explanations about what kind of effects are expected by smelling it (such information can usually be seen in showcases near the fragrance products). Such advance information may prevent consumers from reacting negatively

to the stimuli according to their individual experiences with that particular fragrance and, therefore, produce relatively consistent psychological effects. It has not been tested so far whether or not the placebo effect plays a role in the effect of lavender and jasmine.

To test the contribution of the placebo effect, participants in the present study smelled lavender and jasmine with or without advance information about the effects of the fragrances on their mood states. Two types of information were provided: the first was "relaxing information;" in this case, participants were told that they would feel relaxed as a result of smelling the fragrance. The other was "stimulating information;" in this case, participants were told that they would be stimulated by the smell. Each fragrance was presented in one of the three information conditions (i.e., relaxing, stimulating, and no information). By comparing subjective ratings of mood states among the three conditions, the contribution of advance information was tested in two cases: first, when the information was the same as the effect of fragrance as generally known in aromatherapy and psychological fields (i.e., relaxing for lavender, stimulating for jasmine); and second, when the information was different from the expected effect (vice versa).

Methods

Participants

Thirty healthy undergraduates (12 males, 18 females) participated in this experiment as volunteers. Their mean age was 21.1 (SD = 2.33). All of them were novice to this kind of experiment and were confirmed prior to the experiment that they did not report their aversive responses for the fragrance stimuli in the present study.

Fragrance stimuli

An essential oil of lavender (10%) and an absolute (extracted via volatile solvent and alcohol) of jasmine (5%) were used as the experimental fragrance stimuli. Both stimuli were diluted with triethyl citrate. These stimuli were placed in a 60 ml bottle with the amount resulting from two pushes of an atomizer for lavender (about 0.02 ml) and one push for jasmine (about 0.01 ml). The density and the amount of the fragrance stimuli was decided by a professional perfumer so that both stimuli had perceptually similar intensities at a moderate level and were the same as those used in Higuchi et al. (2002).

Measures of subjective mood states

Nine mood-descriptive adjectives selected in Higuchi et al. (2002) were used for measuring their subjective mood of "relaxed," "stress reduced," and "stimulated." These adjectives were chosen for describing subjective mood states evoked by smelling fragrances on the basis of the following procedures. Fifty participants rated ten vegetal fragrances (e.g., floral, herbal, citrus) in terms of 48 mood-descriptive adjectives (e.g., anxious, excited, calm, comfortable). A factor analysis for the ratings resulted in three factors: relaxed, stressed, and stimulated (enhanced). Three representative adjectives for each factor were selected mainly on the basis of the factor loadings of each adjective. Finally, the relaxing factor was represented "peaceful," "calm," and "quiet;" the stress factor as "nervous," "fidget," and "uneasy;" and the stimulating factor as

"exhilarated," "refreshed," and "cheerful" (see Footnote 2 for Japanese adjectives). In the present study, the participants were required to rate their mood states in terms of the nine adjectives using a seven-point scale from 0 to 6.

Procedures

Participants were randomly assigned to either of three information conditions, the only restriction being that each group contain four males and six females. For the participants in the no information group, the two fragrances were presented without any verbal information about the fragrances. For the participants in the two other information groups, one of the two fragrances was presented together with information about either a relaxing or a stimulating effect of the fragrance. This meant that one information group got information about the generally recognized effect of the fragrance (i.e., a relaxing effect for lavender and a stimulating one for jasmine), whereas the other group got the reverse information (i.e., stimulating for lavender and relaxing for jasmine).

In the experiment, the participants sat on a comfortable chair with large backrest and armrests. The bottle containing the fragrance was set in front of the participants' nose by using an apparatus made of adjustable metal bars at a distance of 10 cm from their nose. All participants rested for 3 min prior to the experiment and then were instructed that the purpose of this experiment was to examine the effect of fragrance generally known in an everyday experience. Advance information was then given to the participants in the two advance information groups before presenting the fragrance. In the relaxing information condition, the participants were instructed that this fragrance was considered to possess a sedative effect, meaning that the fragrance would suppress their anger and feeling of anxiety, make them feel relaxed and calm, alleviate physical pain, and regulate digestive functions. In the stimulation information condition, by contrast, the participants were told that the fragrances was considered to enhance their mood, meaning that the fragrance would remove their feeling of lethargy and apathy, make them feel refreshed and invigorated, and help them achieve strong and fresh skin.

For 5 min, the participants smelled one of the fragrances, the order of which was randomly assigned. If they could not perceive any smell from the bottle, they were free to change the position of the bottles or shake it so that the smell could easily come out. They rated their subjective mood states in terms of 9 mood descriptive words three times: after the 3 min rest period prior to the experiment (a baseline rating), immediately after they began to smell the fragrance (an immediate rating), and immediately after they finished smelling the fragrance for 5 min (an after-5-min rating). A 3 min rest period was given between the end of the rating for the fragrance presented first and the beginning of any procedure for the subsequent fragrance.

Dependent measures and statistical analyses

Dependent measures are within-participant changes in the ratings of three aspects of mood states (relaxed, stress-reduced, and stimulated) from the baseline rating (i.e., the rating taken prior

2. Nine mood-descriptive adjectives in Japanese were "yuttari-shita", "yawaraida", "bonyari-shita" (words for the relaxing factor), "iraira-shita", "ochitsukanai", and "fuanna" (words for the stress factor), "soukaina", "sukkiri-shita", "sugasugashii" (words for the stimulating factor).

to the experiment) to (a) the immediate rating (i.e., the rating taken immediately after the smelling) and (b) the after-5-min rating (i.e., the rating taken after smelling for 5 min). In order to calculate the dependent measures, each score of the nine adjectives of the immediate and the after-5-min ratings was subtracted from that of the baseline rating. Each aspect of mood states was then expressed by an average of three subtracted scores that represented the aspect. With regard to the stress aspect, a minus sign was added after the calculation of the average of three scores so that the positive value of each aspect meant positive changes in mood states. From this procedure, the "stress" aspect was replaced with a "stress-reduced" aspect.

Based on the calculations, scores of the three aspects of mood states in the two phases were obtained from each participant for each fragrance. As a statistical analysis, a two-way ANOVA, Information (3) × Phase (2), with repeated measures on Phase was conducted for each aspect of mood state for each fragrance.

Results

Lavender

Figure 1 shows the mean within-participant changes in mood states from the baseline to the immediate and after-5-min ratings in each information group when participants smelled lavender. For the relaxed aspect, the main effect of Phase was significant (F (1,27) = 4.75, $p < 0.05$), showing that the difference scores of the relaxed aspects were significantly higher in the after-5-min ratings than in the immediate rating. Neither the main effect of Information nor the interaction of the two factors was significant. For the stress-reduced aspect, the main effect of Information was significant (F (2,27) = 3.52, $p < 0.05$). Post hoc comparisons showed that the score was significantly higher in the relaxing information group than in the no information group

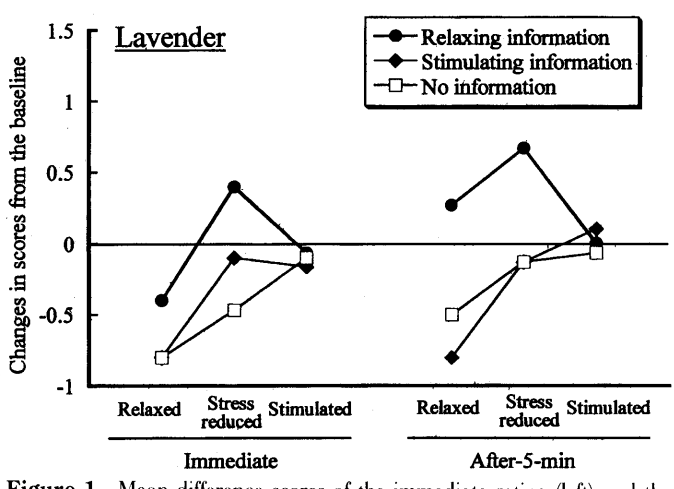

Figure 1. Mean difference scores of the immediate rating (left) and the after-5-min rating (right) in mood states for each information group when participants smelled lavender. Positive values in all three mood aspects mean the positive changes in mood states from the baseline.

($p < 0.05$) and in the stimulating group ($p < 0.07$). The main effect of Phase failed to reach a significant level (F (1,27) = 3.00, $p < 0.10$). The interaction was not significant. For the stimulated aspect, neither the main effects nor the interaction was significant.

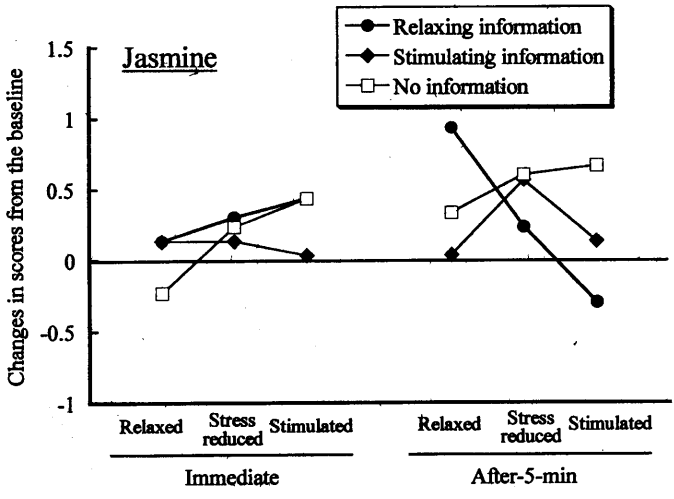

Figure 2. Mean difference scores of the immediate rating (left) and the after-5-min rating (right) in mood states for each information group when participants smelled jasmine. Positive values in all three mood aspects mean the positive changes in mood states from the baseline.

Jasmine

Figure 2 shows the mean within-participant changes in mood states from the baseline to the immediate and after-5-min ratings in each information group when participants smelled jasmine. For the relaxed aspect, only the main effect of Phase was significant (F (1,27) = 5.33, $p < 0.05$), showing that the scores were significantly higher in the after-5-min ratings than in the immediate rating. For the stress-reduced aspect, the main in effect of Phase was nearly significant (F (1,27) = 3.12, $p < 0.10$). Neither the main effect of Information nor the interaction of the two factors was significant. For the stimulated aspect, a significant interaction was found (F (2,27) = 3.64, $p < 0.05$). Post hoc analysis revealed that, in the after-5-min rating, the score of the no information group was significantly higher than that in the relaxing information group, as well as that in the relaxing information group, the score in the after-5-min rating was significantly lower than that in the immediate rating.

Discussion

Different effects between lavender and jasmine

The results showed that explaining in advance the psychological effects that a fragrance was expected to possess had different effects on the subjective mood states in the case of smelling lavender and jasmine. In the case of smelling lavender, participants in the relaxing information

group positively changed their mood states in terms of the stress-reduced aspects from the baseline, and the change was significantly larger than those in the two other groups. In the case of smelling jasmine, by contrast, participants in the no information group were in significantly better mood states in terms of the stimulated aspects than those in the relaxing information group when the mood states were measured after a 5 min exposure to jasmine. These findings suggest that advance information can help achieve a sedative (stress-reducing) effect in the case of lavender but that it negatively affected the stimulating effect of jasmine.

It appears that the differences between lavender and jasmine can be explained in terms of the interaction between what kinds of perceptual characteristics are expected as a result of the advance information and the perceptual characteristics that lavender and jasmine actually possess. Lavender is perceived as a perceptually intense stimulus (Higuchi et al., 2002). Because perceptually intense fragrances frequently cause stressful mood states (Henion, 1971; Higuchi et al., 2002; Montcrieff, 1966), the sedative effect that lavender potentially has should be easy to block. The relaxing information appeared to make the participants accept the perceptual intensity of lavender and expect future effects (i.e., the attitude that "a good medicine tastes bitter") and therefore to help to bring the sedative (stress-reducing) effect. Jasmine were rated as a highly "intense" but less "clear" and as obviously different from many fragrances that are generally considered to have a stimulating effect, such as lemon, peppermint, or rosemary (these fragrances were rated as highly "clear;" Higuchi et al., 2002). It appears that the stimulating information made the participants expect to be presented with a fragrance containing such "clear" olfactory characteristics and that jasmine was not one of the expected fragrances. Such differences in olfactory characteristics of the expected and presented fragrances may negatively affect the stimulating effect that jasmine potentially had.

The validity of the explanations can be tested by examining the effect of the advance information on another fragrance which has the same perceptual characteristics as lavender and jasmine. Higuchi, Shoji, and Hatayama (in press) tried to classify fragrances based on perceptual similarities and showed that, regardless of the method of classification (i.e., verbal or nonverbal), lavender was categorized in the same group as chamomile, pepper, and rosemary, whereas jasmine was categorized in the same group as ylang-ylang. These fragrances should be suitable for testing the aforementioned explanations.

As another explanation of the different effects of lavender and jasmine, it is also possible that only the relaxing information can bias the participants toward rating their mood states along with the information, irrespective of the perceptual characteristics of fragrances. Figure 2 shows that, even in the case of jasmine, the participants in the relaxing information group showed relaxing mood states 5 min after jasmine was presented. This may imply that only the relaxing information has a powerful placebo effect.

Effects of long-time exposure to fragrances

Another finding in the present study was that 5 min exposure to either lavender or jasmine increased the participants' mood states significantly in the relaxed aspect ($p < 0.05$) and nearly significantly in the stress-reduced aspect ($p < 0.10$). This suggests that both fragrances have a

sedative effect if presented for a relatively long time (at least 5 min). A similar finding was obtained in a study by Yagyu (1994), in which both lavender and jasmine increased the alpha ingredients in EEG patterns for the participants who liked the smell of the fragrances, whereas for the participants who did not like the smell as much, lavender slightly increased the alpha ingredients while jasmine increased the beta ingredients. The findings of Yagyu and the present study may imply that, irrespective of the chemical and/or perceptual characteristics of fragrances, presenting individuals with a fragrance that they prefer or with a fragrance with a long-time exposure has the potential to have a sedative effects on their mood.

This finding also implies that a relatively long-time exposure to a fragrance may be a necessary condition for accurately describing the olfactory characteristics of fragrances, especially if the fragrances are expected to have a sedative effect. In our previous study, participants rated fragrance stimuli like jasmine, rosemary, rose, and lavender as relatively strong and as less associated with relaxation (Higuchi et al., 2002). These ratings were inconsistent with the relaxing effect of these fragrances as generally recognized in aromatherapy (e.g., Hayashi, 1998). In our previous study, the participants were required to rate these stimuli immediately after smelling them. Based on the present results, the inconsistent ratings with the generally recognized effect of a fragrance may come from immediate ratings after a short-time exposure.

Placebo effect?

The results of the present study suggest the tentative conclusion that the advance information about the effct of a fragrance can have a role in producing psychological effects of a fragrance; however, some restrictions on the role are observed, i.e., whether it is effective only for some fragrances or it is only the relaxing information that causes the placebo effect. This implies that, if fragrances are used in practices such as aromatherapy, advance information could be useful to decrease individual differences in emotional reactions to fragrances and bring relatively consistent psychological effects.

Finally, further discussion is needed concerning whether this information effect should be called "the placebo effect." In pharmacology, medicines are tested to demonstrate that their potency is certainly derived from their pharmacological effects rather than by a placebo effect. In this sense, to show the existence of the placebo effect is to question the pharmacological effect of fragrances brought by chemical processes. However, as Jellinek (1994, 2002) stated, the placebo effect is compatible with the chemical/pharmacological effect in the effects of fragrances. Therefore, researchers should find another name, rather than the placebo effect, for the effect of advance information. Dalton (2002), in his intensive review of olfactory studies, referred to the effects as "top-down (conceptually-driven) factors" brought by complex environment surrounding the exposure to fragrances (pp.727). Although "top-down factors" can be used in a broad sense, such a name is worth discussing in the sense that it aims to express the role of higher cognitive functions such as expectancy or likelihood that are aroused by advance information.

Acknowledgements

We would like to thank Hisae Satoh for helping us perform our experiments. We also appreciate the assistance received from Adriana Treadway for correcting our English sentences.

References

Ayabe-Kawamura, S., Schicker, I., Laska, M., Hudson, R., Distel, H., Kobayakawa, T., & Saito, S. (1998). Differences in perception of everyday odors: A Japanese-German cross-cultural study. *Chemical Senses*, **23**, 31-38.

Baeyens, F., Wrzesniewski, A. Houwer, J. D. & Eelen, P. (1996). Toilet rooms, body massages, and smells: Two field studies on human evaluative odor conditioning. *Current Psychology: Developmental, Learning, Personality, Social*, **15**, 77-96.

Dalton, P. (2002). Olafaction, In *Stevens' Handbook of Experimental Psychology (3rd ed.) volume 1: Sensation and Perception*. New York: Wiley, Pp. 691-746.

Hayashi, S. (1998). *Encyclopedia of aromatherapy (In Japanese)*. Japan: Tokyo-do Press.

Henion, K. E. (1971). Pleasantness and intensity: A single dimension? *Journal of Experimental Psychology*, **90**, 275-279.

Higuchi, T., Shoji, K., & Hatayama, T. (2002). A psychological study of sense-descriptive adjectives for characterizing the fragrance (In Japanese with English summary). *Japanese Journal Research on Emotions*, **8**, 45-59.

Higuchi, T., Shoji, K., & Hatayama, T. (in press) Multidimensional scaling of fragrances: A comparison between the verbal and nonverbal methods of classifying fragrances. *Japanese Psychological Research*.

Jellinek J. S. (1994). Aromatherapy: A status review. *Cosmetics and Toiletries*, **109**, 83-101.

Jellinek J. S. (2002). *Kaori no Kigouron (In Japanese)*. Japan: Ningentorekishisha.

Kanamura, S., Kawasaki, M., Indo, M., Sukuda, H., & Torii, S. (1988). Effect of odors on the contingent negative variation and the skin potential level. *Chemical Senses*, **13**, 326.

Kirk-Smith, M. D. & Booth, D. A. (1987). Chemoreception in human behavior: experimental analysis of the social effects of fragrances. *Chemical Senses*, **12**, 159-166.

Knasko, S. S., Gilbert, A. N., & Sabini, J. (1990). Emotional state, physical well-being, and performance in the presence of a feigned ambient odors. *Journal of Applied Social Psychology*, **20**, 1346-1357.

Miyake, Y., Nakagawa, M., and Asakura, Y. (1991). Effect of odors in humans (I): Effects of sleep latency. *Chemical Senses*, **16**, 183.

Montcrieff, R. W. (1966). *Odour Preferences*. New York: Wiley.

Okazaki, Y. (1992). Perfumes and application of contingent negative variation (In Japanese). *Fragrance Journal, 1992-10*, 80.

Schleidt, M., Neumann, P. & Morishita, H. (1988). Pleasant and disgust: memories and associations of pleasant and unpleasant odours in Germany and Japan. *Chemical Senses*, **13**, 279-293.

Sellar, W. (1992). *The Direction of Essential oils*. UK: Daniel Company.

Steiner, W. (1994). Die Wirkung von Gerüchen auf das Erleben und Verhalten des Menschen. In P. Jellinek. *Die Psychologischen Grundlagen der Parfümerie* (4th Ed.), Heidelberg: Hüthing. Pp. 209-211. (Cited from J. S. Jellinek, 2002, *Kaori no Kigouron (In Japanese)*. Japan: Ningentorekishisha)

Sugano, H. (1992). Psychophysiological studies of fragrances. In S. Van Toller & G. H. Dodd (Eds.), *Fragrance: The Psychology and Biology of Perfumery*. London: Elsevier, Pp. 221-228.

Torii, S., Fukuda, H., Kanemoto, H. Miyauchi, R., Hamauzu, Y. & Kawasaki, M. (1988). Contingent negative variation (CNV) and the psychological effects of odour. In S. Van Toller & G. H. Dodd (Eds.), *Perfumery: The Psychology and Biology of Fragrance*. New York: Champaign and Hall, Pp. 107-120.

Walter, W. G., Cooper, R., Aldridge, V. M., McCallum, W. C., & Winter, A. L. (1964). Contingent negative variation: an electric sign of sensori-motor association and expectancy in the human brain. *Nature*, **203**, 380-384.

Yagyu, T. (1994). Neurophysiological findings on the effects of fragrance: Lavender and jasmine. *Integrative Psychiatry*, **10**, 62-67.

Zellner, D. A. & Whitten, L. A. (1999). The effect of color intensity and appropriateness on color-induced odor enhancement. *American Journal of Psychology*, **112**, 585-604.

(Received January, 20 2003)
(Accepted March, 3 2003)